

We claim:

1. A method of reducing the sulfur content of a catalytically cracked petroleum fraction, which comprises catalytically cracking a petroleum feed fraction containing organosulfur compounds at elevated temperature in the presence of a cracking catalyst and a product sulfur reduction catalyst which comprises a porous molecular sieve having (i) a first metal component which is within the interior pore structure of the molecular sieve and which comprises a metal in an oxidation state greater than zero and (ii) a second metal component comprising cerium which is within the interior pore structure of the molecular sieve, to produce a liquid cracked product fraction of reduced sulfur content.
2. A method according to claim 1 in which the product sulfur reduction catalyst comprises a large pore size or intermediate pore size zeolite as the molecular sieve component and, as the first metal component, at least one metal of Period 3, Groups 5, 8, 9 or 12 of the Periodic Table.
3. A method according to claim 2 in which the large pore size zeolite comprises a faujasite zeolite.
4. A method according to claim 2 in which the large pore size zeolite comprises zeolite USY.
5. A method according to claim 2 in which the first metal component comprises vanadium.
6. A method according to claim 1 in which the second metal component is present in an amount from 0.5 to 10 weight percent of the catalytic composition.
7. A method according to claim 1 in which the product sulfur reduction catalyst comprises a USY zeolite having a UCS of from 2.420 to 2.455nm, a bulk silica:alumina ratio of at least 5.0 as the molecular sieve component and, as the first metal component, at least one of zinc or vanadium in an oxidation state greater than zero.

8. A method according to claim 1 in which the sulfur reduction catalyst is a separate particle additive catalyst.

9. A method according to claim 1 in which the liquid cracking product fraction of reduced sulfur content comprises a gasoline fraction.

10. A method according to claim 1 in which the liquid cracking product fraction of reduced sulfur content comprises a fraction boiling above the gasoline fraction.

11. In a fluid catalytic cracking process in which a heavy hydrocarbon feed comprising organosulfur compounds is catalytically cracked to lighter products by contact in a cyclic catalyst recirculation cracking process with a circulating fluidizable catalytic cracking catalyst inventory consisting of particles having a size ranging from about 20 to about 100 microns, comprising:

(i) catalytically cracking the feed in a catalytic cracking zone operating at catalytic cracking conditions by contacting feed with a source of regenerated cracking catalyst to produce a cracking zone effluent comprising cracked products and spent catalyst containing coke and strippable hydrocarbons;

(ii) discharging and separating the effluent mixture into a cracked product rich vapor phase and a solids rich phase comprising spent catalyst;

(iii) removing the vapor phase as a product and fractionating the vapor to form liquid cracked products including gasoline and cycle oil,

(iv) stripping the solids rich spent catalyst phase to remove occluded hydrocarbons from the catalyst,

(v) transporting stripped catalyst from the stripper to a catalyst regenerator;

(vi) regenerating stripped catalyst by contact with oxygen containing gas to produce regenerated catalyst; and

(vii) recycling the regenerated catalyst to the cracking zone to contact further quantities of heavy hydrocarbon feed,

the improvement which comprises

reducing the sulfur content of the liquid cracked products, by catalytically cracking the feed fraction at elevated temperature in the presence of a product sulfur reduction

catalyst which comprises a porous molecular sieve having (i) a first metal component which is within the interior pore structure of the molecular sieve and which comprises a metal in an oxidation state greater than zero and (ii) a second metal component which is within the interior pore structure of the molecular sieve and which comprises cerium.

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12. A method according to claim 11 in which the cracking catalyst comprises a matrixed faujasite zeolite.

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13. A method according to claim 12 in which the product sulfur reduction catalyst comprises a large pore size or intermediate pore size zeolite as the molecular sieve component, vanadium as the first metal component and cerium as the second metal component.

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14. A method according to claim 13 in which the large pore size zeolite of the product sulfur reduction catalyst comprises zeolite USY.

15. A method according to claim 11 in which the liquid cracking products comprise a gasoline fraction of reduced sulfur content.

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16. A method according to claim 11 in which the liquid cracking products comprise a fraction of reduced sulfur content boiling above the gasoline fraction.

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17. A fluidizable catalytic cracking product sulfur reduction catalyst for reducing the sulfur content of a catalytically cracked gasoline fraction during the catalytic cracking process, which comprises fluidizable particles having a size ranging from about 20 to about 100 microns of (i) a porous molecular sieve component, (ii) a first metal component comprising a metal in an oxidation state greater than zero located within the interior pore structure of the porous hydrocarbon cracking component and (ii) a second metal component comprising cerium located within the interior pore structure of the porous molecular sieve.

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18. A fluidizable catalytic cracking product sulfur reduction catalyst according to claim 17 in which the molecular sieve component comprises a porous zeolite hydrocarbon cracking catalyst component.

5 19. A fluidizable catalytic cracking product sulfur reduction catalyst according to claim 18 in which the porous hydrocarbon cracking component comprises zeolite USY having a UCS of from 2.420 to 2.455 nm and a bulk silica:alumina ratio of at least 5.0.

10 20. A fluidizable catalytic cracking product sulfur reduction catalyst according to claim 18 in which the porous hydrocarbon cracking component comprises zeolite USY having a UCS of from 2.420 to 2.435 nm and a bulk silica:alumina ratio of at least 5.0.

15 21. A fluidizable catalytic cracking product sulfur reduction catalyst according to claim 17 which contains from 0.2 to 5 weight percent vanadium as the first metal component, based on the weight of the molecular sieve.

22. A fluidizable catalytic cracking product sulfur reduction catalyst according to claim 17 which comprises 0.5 to 5 weight percent of cerium as the second metal component.

20 23. A fluidizable catalytic cracking product sulfur reduction catalyst according to claim 17 in which the metal components have been introduced into the zeolite as exchanged cationic species within the zeolite pores.

25 24. A fluidizable catalytic cracking product sulfur reduction catalyst according to claim 17 formulated as a cracking catalyst additive with a matrix component.

25 25. A fluidizable catalytic cracking product sulfur reduction additive catalyst according to claim 17 which is formulated as an integrated fluidizable catalytic cracking/product sulfur reduction catalyst for cracking a heavy hydrocarbon feed to produce liquid cracking products including gasoline and reducing the sulfur content of the catalytically cracked gasoline fraction during the catalytic cracking process, which comprises fluidizable particles having a size ranging from about 20 to about 100 microns of a zeolite hydrocarbon cracking catalyst component, a bulk silica:alumina ratio of at least 5.0 which

contains located within the pore structure of the zeolite (i) a first metal component which comprises at least one of at least one metal of Period 3, Groups 5, 8, 9 or 12 of the Periodic Table in an oxidation state greater than zero and (ii) a second metal component which comprises cerium.

26. An integrated fluidizable catalytic cracking/product sulfur reduction catalyst according to claim 25 which contains from 0.1 to 5 weight percent, based on the weight of the zeolite, of vanadium as the first metal component.

10 27. An integrated fluidizable catalytic cracking product sulfur reduction catalyst according to claim 25 which comprises 0.5 to 5 weight percent of cerium as the second metal component.

15 28. An integrated fluidizable catalytic cracking product sulfur reduction catalyst according to claim 24 in which the porous hydrocarbon cracking component comprises zeolite USY having a UCS of from 2.420 to 2.455nm and a bulk silica:alumina ratio of at least 5.0.

20 29. An integrated fluidizable catalytic cracking product sulfur reduction catalyst according to claim 24 in which the porous hydrocarbon cracking component comprises zeolite USY having a UCS of from 2.420 to 2.435nm and a bulk silica:alumina ratio of at least 5.0.

25 30. A fluidizable catalytic cracking product sulfur reduction catalyst according to claim 25 which is formulated with a matrix component and the cracking component as an integrated fluid cracking/sulfur reduction catalyst.